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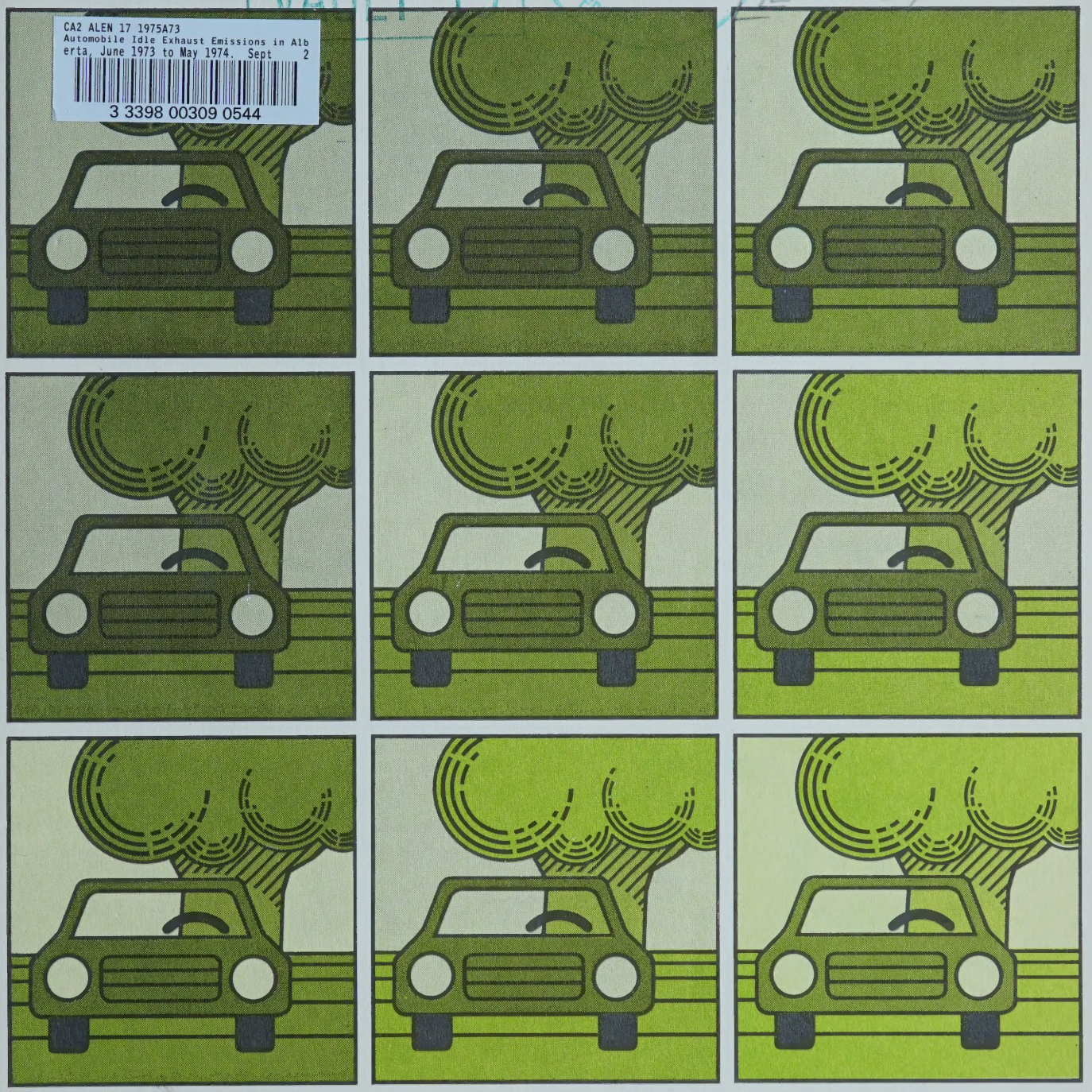

AUTOMOBILE IDLE EXHAUST EMISSIONS 1974

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Automobile Idle Exhaust Emissions in Alberta

June, 1973, to May, 1974

Report Prepared By:

Alberta

ENVIRONMENT

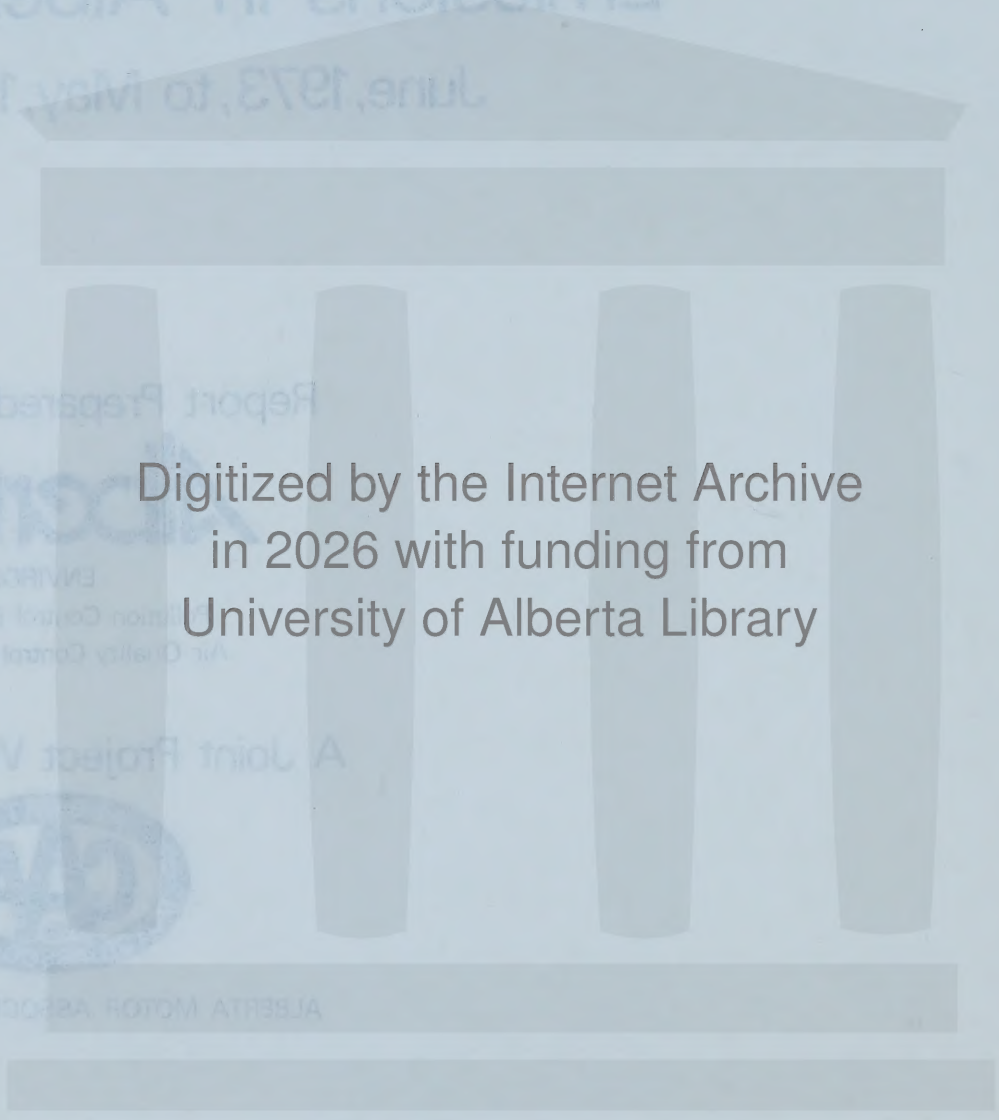
Pollution Control Division

Air Quality Control Branch

A Joint Project With:

ALBERTA MOTOR ASSOCIATION

Published September, 1975



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ABSTRACT

Statistics presented in this report were obtained during a one year Emission Testing Program sponsored jointly by the Alberta Motor Association and the Government of Alberta, Department of the Environment.

During the testing program, which operated from June 1, 1973, to May 31, 1974, exhaust emission tests were conducted on 10,528 vehicles in 34 Alberta communities. All tests were conducted with engines at idle speed, and although no detailed record of ambient temperature was maintained, the program examined exhaust emissions during all climatic conditions. The cause of excessive emissions was not determined.

Based on the arbitrary pass-fail criteria, discussed in the text, 37.5% of the vehicles tested recorded excessive carbon monoxide concentrations while 3.8% of the vehicles tested had excessive hydrocarbon concentrations. The results also indicated a continuing decrease in excessive concentrations of late model vehicles.

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Introduction:

The Alberta Motor Association in co-operation with the Government of Alberta, Department of the Environment, entered into a year long program of vehicle testing and research.

There were five objectives to the program:

(a) To educate and inform the public of measures being taken by government and industry to prevent air pollution;

(b) To provide a means for the public for comparison of their vehicles to acceptable rates of exhaust emissions;

(c) To encourage individuals to maintain their vehicles, in an effort to protect our environment;

(d) To determine the concentration of emissions expelled by the average automobile in Alberta; and

(e) To publicly demonstrate the concern of government and the association with respect to air pollution.

The two mobile exhaust emission analyzers that were utilized during the course of the program were mounted in truck and camper units. Motorists who volunteered to have their vehicles checked were supplied with information material relating to vehicle emissions and their impact on the environment.

The year long program conducted emission tests on 10,528 vehicles in 34 Alberta centres. These centres included:

Edmonton	Grande Prairie	Red Deer	Lloydminster	Medicine Hat
Calgary	Drayton Valley	Camrose	Wetaskiwin	Peace River
Stettler	Fort McLeod	Brooks	Drumheller	Claresholm
Jasper	Whitecourt	Lacombe	High River	Vegreville
Ponoka	Westlock	Taber	Three Hills	Valleyview
Barrhead	Blairmore	Edson	Pincher Creek	St. Paul
Olds	Athabasca	Hinton	Cochrane	

The vehicle exhaust was analyzed for concentrations of carbon monoxide (CO) and hydrocarbons (HC). Vehicles built prior to 1969 were allowed 7% CO and 0.165% HC concentrations (1650 ppm HC). Vehicles built during and since 1969 were allowed 4.5% CO and 0.135% HC concentrations (1350 ppm HC). For import models the criteria was 4.5% CO and 0.135% HC for 1972 and later models, and 7% CO and 0.165% HC for pre-1972 model automobiles.

The Alberta Motor Association-Alberta Environment program was well advertised through local news media, and the program received good public response in towns and cities throughout the province.

Equipment:

For the purpose of the Emission Testing Program, two Mexa - 300 CO/HC Infrared Analyzers were utilized.

This equipment registered hydrocarbons up to 2,000 parts per million and carbon monoxide from zero to ten percent. These analyzers were calibrated manually on a daily basis and were accurately calibrated through the use of special calibration gas an average of twice weekly. In this way, consistent accuracy was ensured under all climatic conditions.

Each unit was transported throughout the province in a camper unit mounted on a 3/4 ton truck. Each truck and camper pulled a trailer which carried other necessary advertising equipment such as signs. During the colder months of the program the heated campers provided the analyzers with the protection from servere temperatures.

Test Procedures:

Testing sites were selected at random with the only criteria being that they have a high volume of vehicular traffic. The testing sites included shopping centres, service stations, and other sites on high traffic volume thoroughfares.

The public were invited to have their vehicles inspected, and upon their arrival at the test site the mileage reading on the odometer was recorded on a daily worksheet. The engine was checked to ensure it was running at normal operating temperature, and the driver of the vehicle was instructed to speed up the engine to about 2,000 RPM in order to clean out residue from the exhaust system.

This being completed the analyzer probe was placed 18 inches into the tailpipe of the idling vehicle. Carbon monoxide and hydrocarbon readings were then taken and recorded. Other items recorded included the model year of the vehicle, the number of engine cylinders, and the engine size as being greater than or less than 400 cubic inch displacement (CID). Daily mean temperatures were also recorded on the worksheet.

Information from daily worksheets was then recorded on data processing cards and computerized statistical reports were prepared.

Where the exhaust emission readings were within acceptable levels, vehicle drivers were presented with a green card congratulating them for maintaining a vehicle which operated within the established criteria. Where limits were not acceptable, the driver was presented with a red card which stated carbon monoxide and hydrocarbon readings, along with suggestions as to why the vehicle may be emitting excessive pollutants.

All participants in the test program were given a specially prepared pamphlet entitled, "A Clean Blow at Dirty Air". This pamphlet described the pollution concern of the Alberta Motor Association and the Government of Alberta, and offered advice on how motorists might co-operate in reducing motor vehicle exhaust pollutants.

Results:

The results of the twelve-month survey are based on tests from 10,528 vehicles. Table 1. illustrates the distribution by model year of vehicles tested. The results in Table 2. illustrate the percentage of vehicles within the carbon monoxide pass-fail criteria. The data illustrate the ever increasing percentage of successful vehicles, coincident with later model year vehicles.

Emission analysis distribution is plotted in Figures 1 to 8. Each of the curves in these figures illustrates percent of vehicle population tested (abscissa) that is within a measured concentration (ordinate). The steady decrease in CO and HC concentration in late model vehicles is evident in Figures 1 & 2. Early model vehicles show little change in concentration (Figures 3 & 4) primarily due to the absence of pollution control equipment. Figure 5 indicates lower CO concentrations at idle for 8 cylinder engines with greater than 400 CID than for other engine classes, with 6 cylinder engines having the highest idle CO concentration of the group. Little difference in CO or HC concentration distribution exists between import model and American model vehicles (Figures 7 & 8). Table 3. illustrates by vehicle class the percent of each vehicle class within the pass-fail criteria. From this table, even though the percent variation is small, import model cars and 4 cylinder engines appear to have the highest fail rate.

Summary:

Late model vehicles have realized a continuing decrease in carbon monoxide and hydrocarbon concentrations. The difference in carbon monoxide and hydrocarbon concentrations between American and import cars seems slight. Eight cylinder engines with greater than 400 CID exhibit the lowest carbon monoxide and hydrocarbon emission concentrations while six cylinder engines exhibit the highest carbon monoxide and hydrocarbon emission concentrations. Under the arbitrary pass-fail criteria of the 10,528 vehicles tested in 1973 - 1974, 37.5% recorded excessive carbon monoxide concentrations while 3.8% recorded excessive hydrocarbon concentrations.

Table 1.

AMA - Alberta Environment Automobile Idle Exhaust Emissions in Alberta

DISTRIBUTION OF VEHICLES TESTED

Model Year	Number	Percent of Total
1966	2,004	19.0
1967	670	6.3
1968	936	8.9
1969	1,071	10.2
1970	1,017	9.7
1971	1,126	10.7
1972	1,674	15.9
1973	1,865	17.7
1974	165	1.6
TOTALS	10,528	100.0

Table 2.

AMA - Alberta Environment Automobile Idle Exhaust Emissions in Alberta

CARBON MONOXIDE CRITERIA

AND

PERCENT OF SUCCESS

Model Year	Percent of Vehicles Within 7% CO Criteria	Percent of Vehicles Within 4.5% CO Criteria
1966	69%	
1967	70%	
1968	75%	
1969		45%
1970		49%
1971		56%
1972		59%
1973		70%
1974		82%*

* This figure is based on a small sample volume of only 1.6% of the total vehicles tested.

Table 3.

AMA - Alberta Environment Automobile Idle Exhause Emissions in Alberta

VEHICLE CLASS AND PERCENT OF SUCCESS

Vehicle Class	Percent of Vehicle Class Within CO Criteria*	Percent of Vehicle Class Within HC Criteria†
American Models	62.9	96.3
Import Models	60.9	95.4
4 CYL Engines	61.2	95.6
6 CYL Engines	65.4	95.9
400 CID 8 CYL	61.6	96.2
>400 CID 8 CYL	67.9	97.2

* allowable CO emission for: 1968 and previous model years - 7%

1969 and later model years - 4.5%

† allowable HC emissions for: 1968 and previous model years - 0.165%

1969 and later model years - 0.135%

SAMPLE	VOLUME	SYMBOL
1973	1,865	– – ——– – –
1972	1,674	————
1971	1,126	– – – – – –
1970	1,017	.....

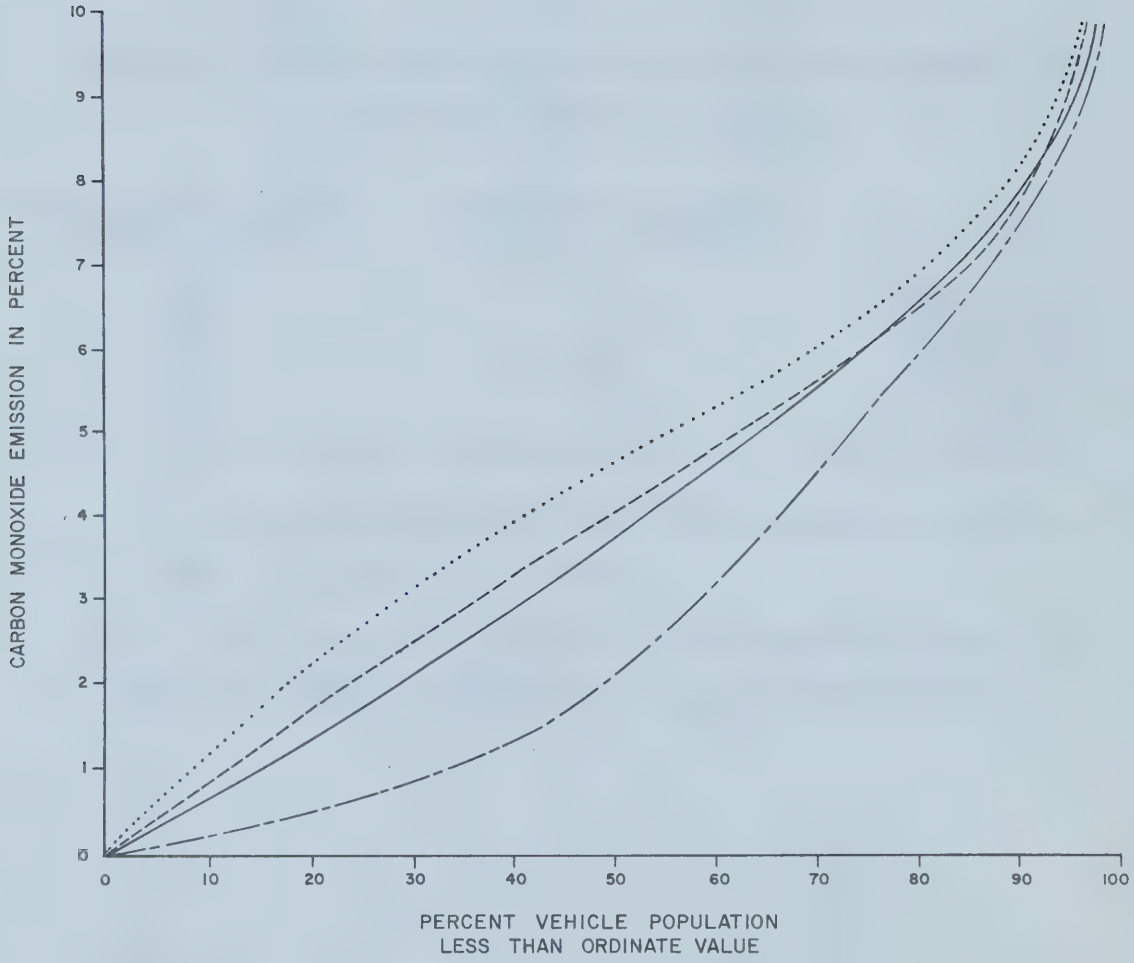

FIGURE 1

DISTRIBUTION OF CARBON MONOXIDE EMISSION AT IDLE

FOR MODEL YEARS 1970 - 1973

AMA - ALBERTA ENVIRONMENT

AUTOMBILE IDLE EXHAUST EMISSIONS IN ALBERTA

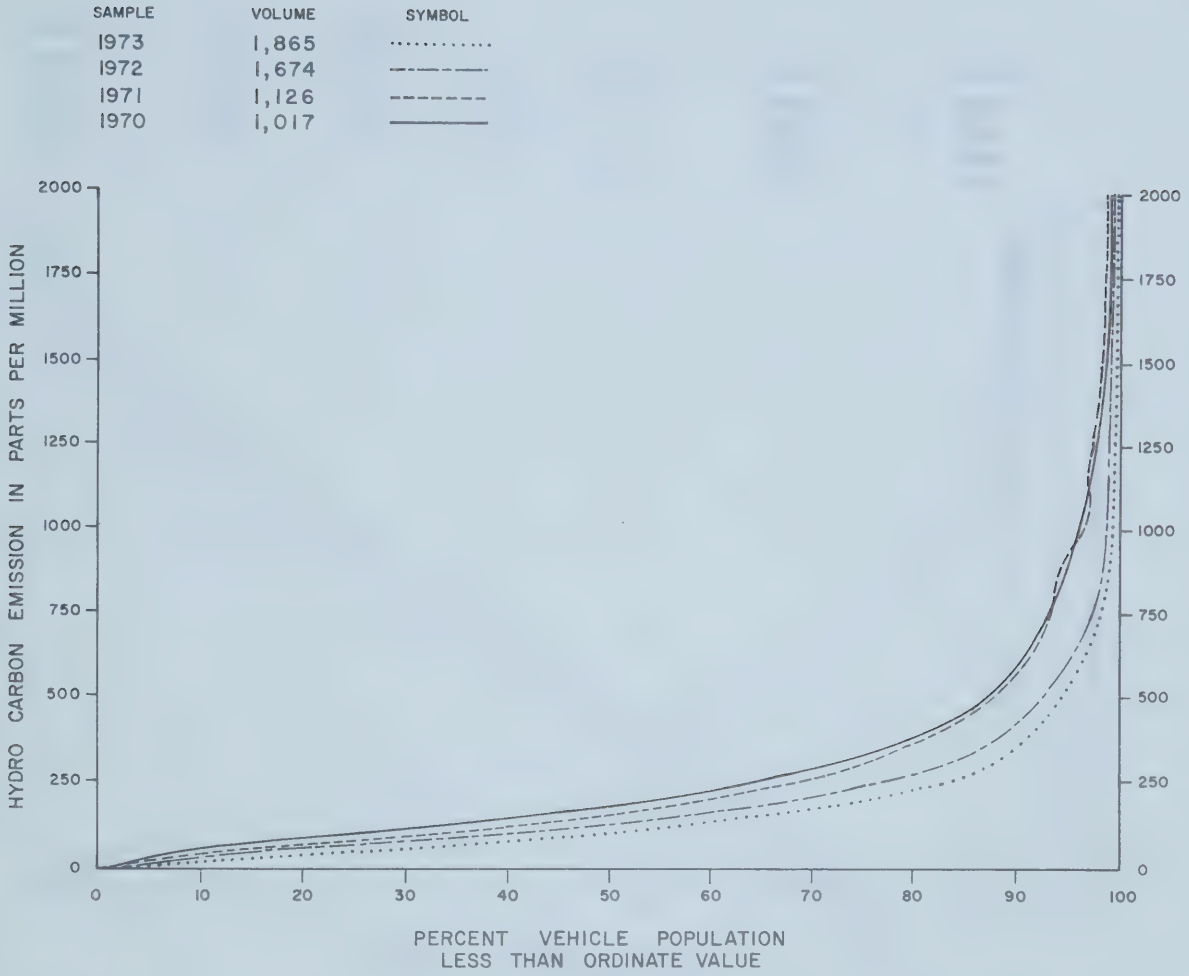

FIGURE 2

DISTRIBUTION OF HYDROCARBON EMISSION AT IDLE
FOR MODEL YEARS 1970-1973

AMA-ALBERTA ENVIRONMENT
AUTOMBILE IDLE EXHAUST EMISSIONS IN ALBERTA

SAMPLE	VOLUME	SYMBOL
1969	1,071	- - - - -
1968	936	.....
1967	670	———
1966	2,004	— — — —

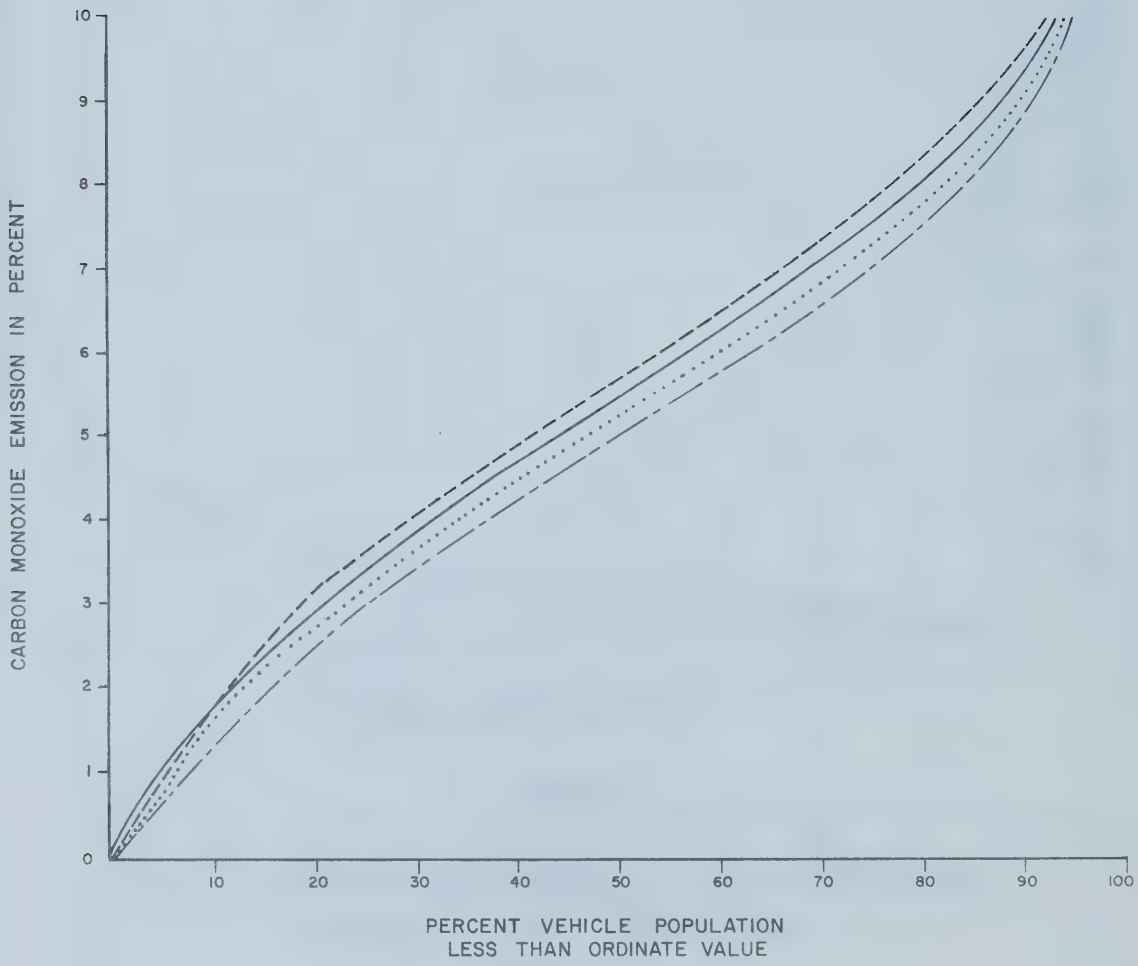

FIGURE 3

DISTRIBUTION OF CARBON MONOXIDE EMISSION AT IDLE

FOR MODEL YEARS 1966 - 1969

SAMPLE	VOLUME	SYMBOL
1969	1,071	·····
1968	936	- - - - - - - -
1967	670	————
1966	2,004	—·—·—

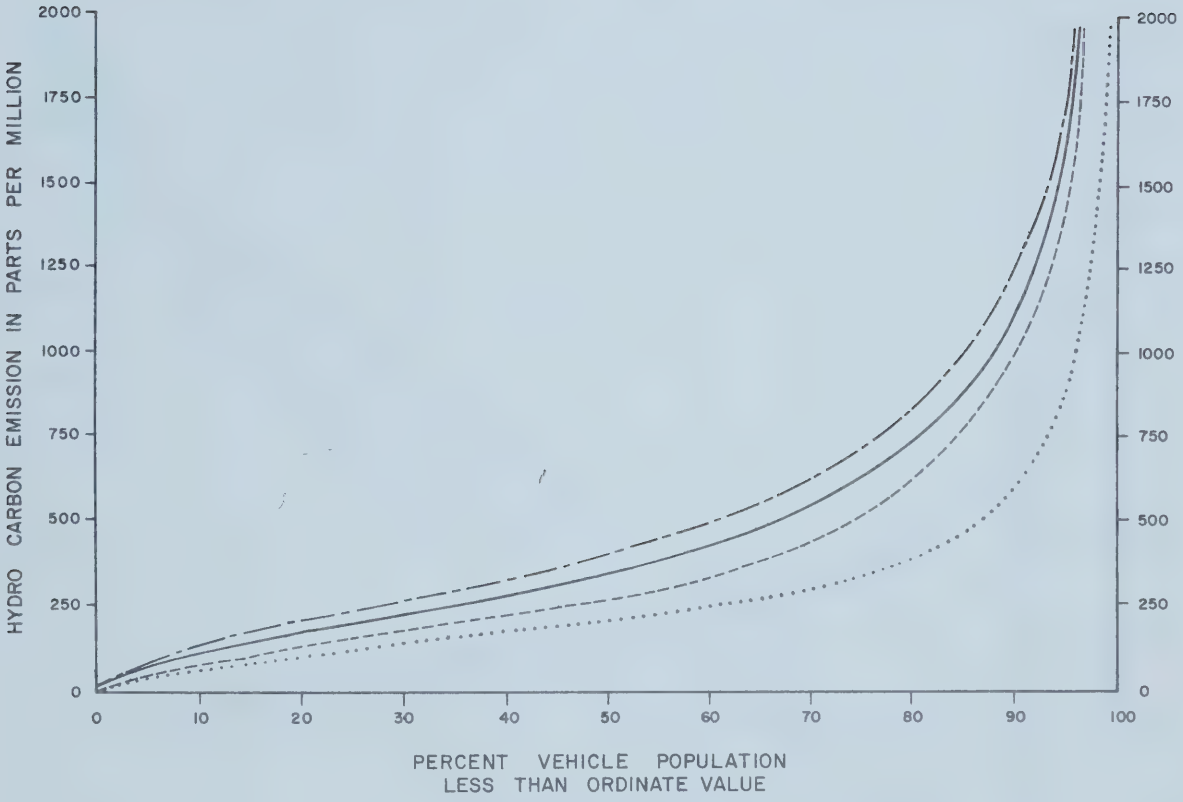

FIGURE 4

DISTRIBUTION OF HYDROCARBON EMISSION AT IDLE

FOR MODEL YEARS 1966-1969

SAMPLE	VOLUME	SYMBOL
4 CYL. ALL MAKES AND YEARS	1,991	– – – –
6 CYL.	1,187	———
8 CYL. < 400 C.I.D.	6,428	·····
8 CYL. > 400 C.I.D.	925	– · ——— · –

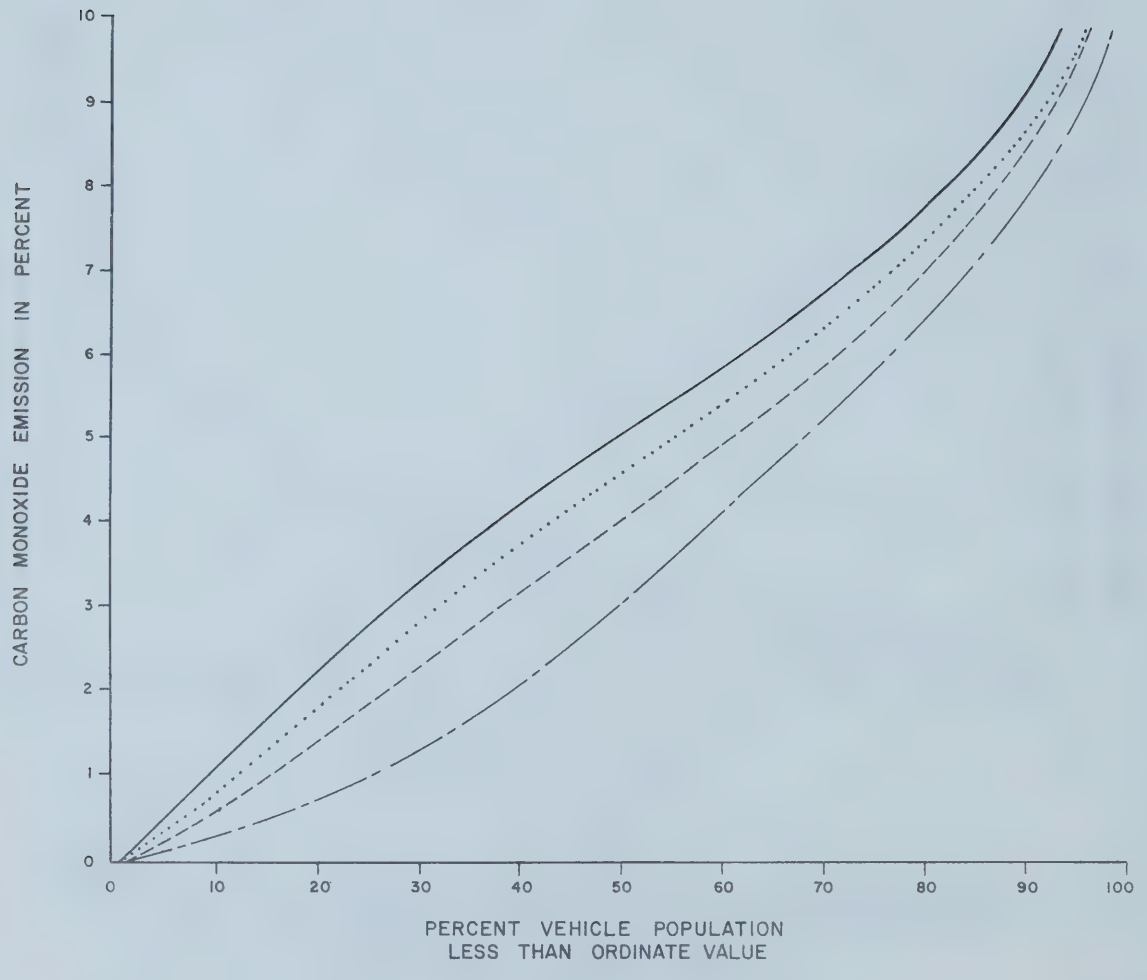

FIGURE 5

DISTRIBUTION OF CARBON MONOXIDE EMISSION AT IDLE

BY ENGINE SIZE

AMA-ALBERTA ENVIRONMENT

AUTOMBILE IDLE EXHAUST EMISSIONS IN ALBERTA

SAMPLE	VOLUME	SYMBOL
4 CYL. ALL MAKES AND YEARS	1,991	·····
6 CYL.	1,187	– – – –
8 CYL. < 400 C.I.D.	6,428	———
8 CYL. > 400 C.I.D.	925	—·—·—

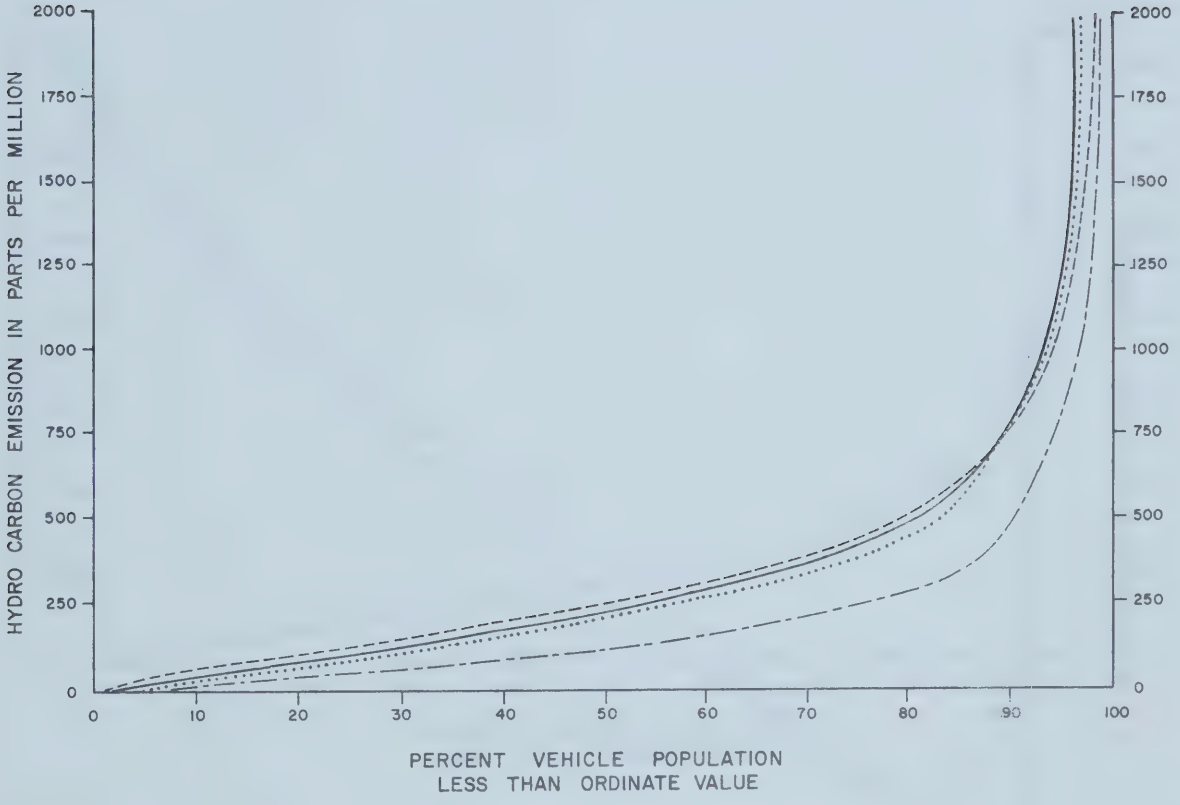

FIGURE 6

DISTRIBUTION OF HYDROCARBON EMISSION AT IDLE BY ENGINE SIZE

SAMPLE	VOLUME	SYMBOL
IMPORT MODELS 1966-1974	1,792	- - - -
AMERICAN MODELS 1966-1974	8,739	———

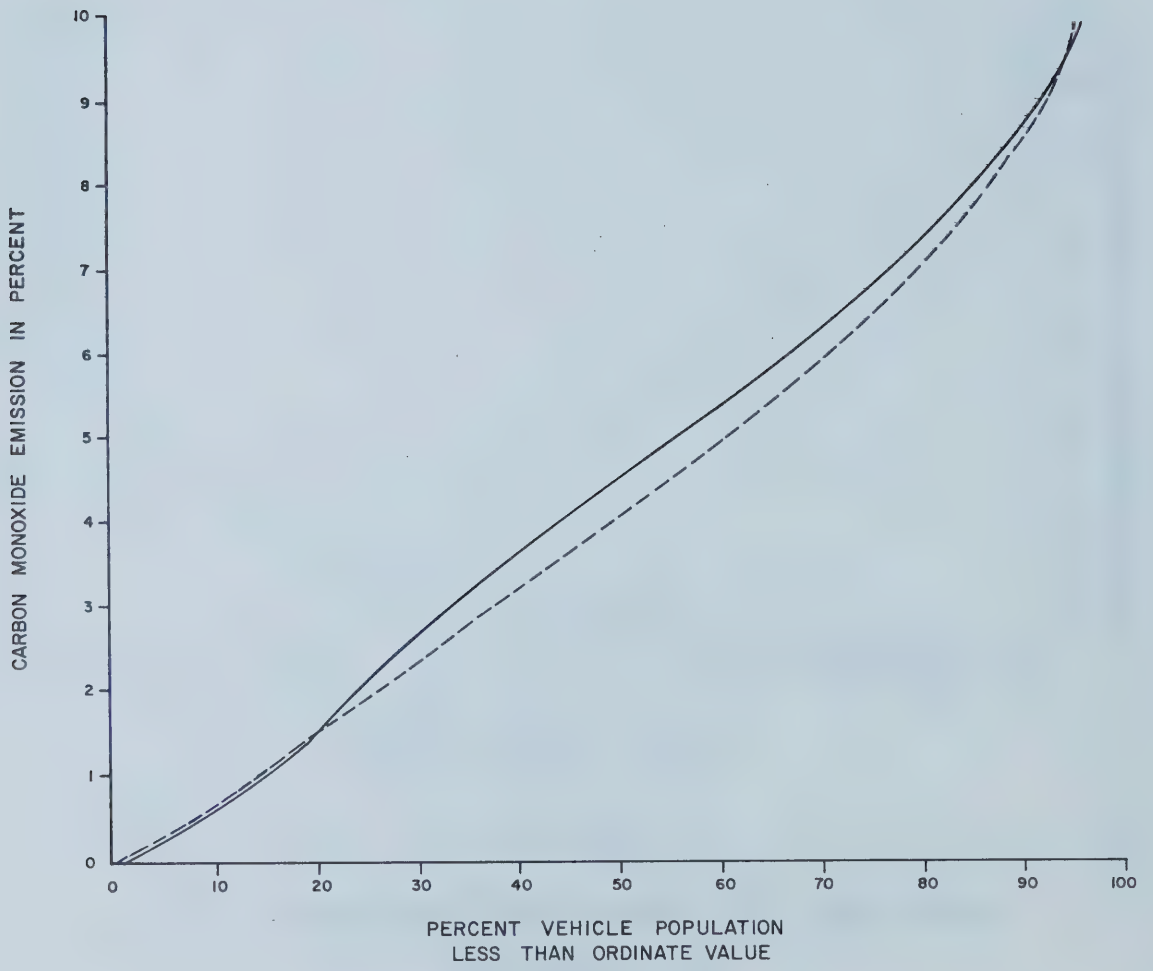

FIGURE 7

DISTRIBUTION OF CARBON MONOXIDE EMISSION AT IDLE FOR AMERICAN AND IMPORTED VEHICLES

SAMPLE	VOLUME	SYMBOL
IMPORT MODELS 1966-1974	1,792	———
AMERICAN MODELS 1966-1974	8,739	- - - - - -

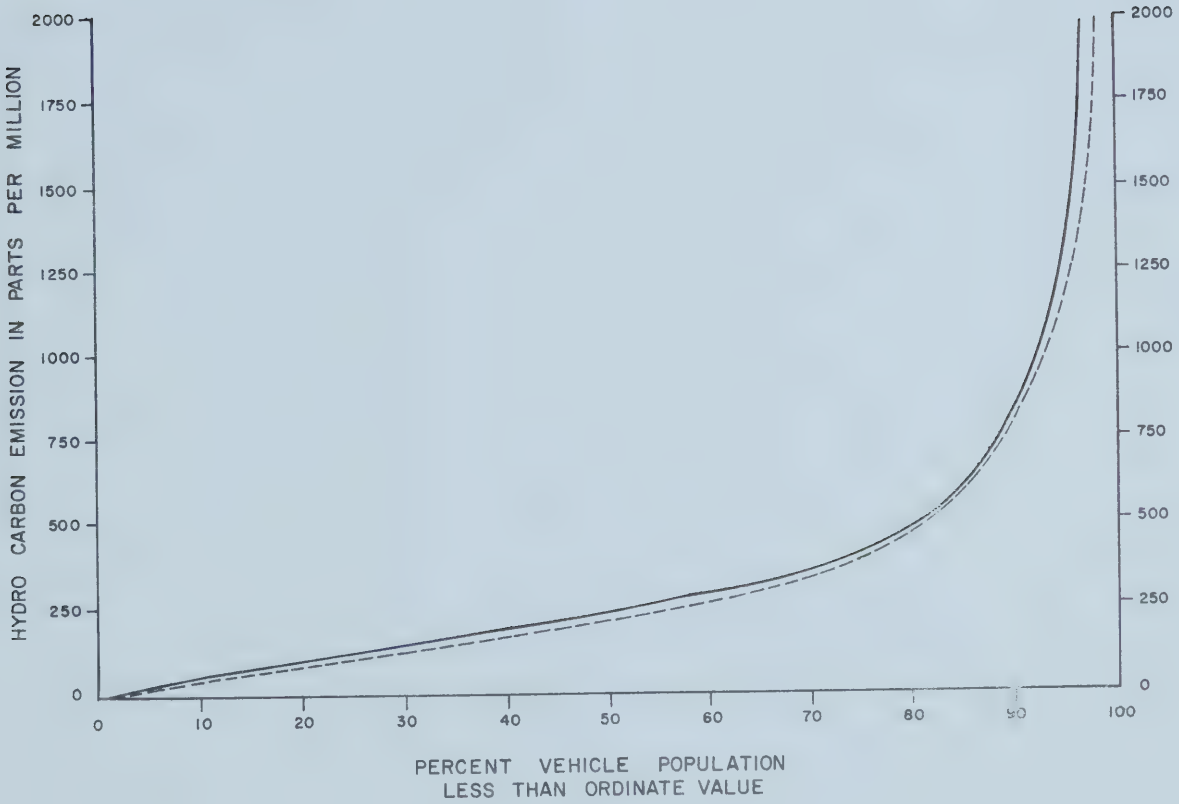

FIGURE 8

DISTRIBUTION OF HYDROCARBON EMISSION AT IDLE FOR AMERICAN AND IMPORTED VEHICLES

Alberta
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